Nonperforming Loans in the GCC Banking Sectors: Does the Islamic Finance Matter?

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Abstract

This paper investigates the bank-level and country-level factors determining nonperforming loans (NPL) in the commercial banking industry of Gulf Cooperation Council (GCC) countries. Specifically; it examines the impact of the sectoral distribution financing growth and Islamic finance methods growth on NPL. To do so, we apply generalized method of moments (GMM) techniques, over the 2005-2011 period. Our findings indicate that the sectoral distribution of Islamic financing has an adverse impact on NPL, which suggest that the sectoral financing growth of Islamic banks increases the credit risk exposure more than conventional banks. The findings of the Islamic finance methods growth show that the impact of fixed-income debt contracts could increase NPL more than profit-and-loss-sharing contracts.

Keywords: Nonperforming loans; commercial banks, Islamic finance, generalized method of moments; GCC countries.

1. Introduction

The determinants of financial stability are important and controversial at the same time. Problem loans can be considered as an important factor for financial stability and source of worry in the banking system in developed as well as in developing countries. One of such sources is the magnitude and the nature of non-performing loans (henceforth NPL*)* as part of credit risk and its management process (see, Demirguc-Kunt, 1989; Whalen, 19991; Farooq and Zaheer, 2015). While NPL remain an important source of risk to be tackled in the conventional banks (CB) (Barr and Siems, 1994; Wheelock and Wilson, 1995), Islamic banks (IB) are also subject to NPL (Baele et al., 2014).

The literature on the determinants of NPL within banking sector is voluminous. There is, however, no research so far (to our best of knowledge) has examined the impact of sectoral financing growth and Islamic financing methods on NPL. Commercial and Islamic banking are influenced by both the microeconomic dynamics and macroeconomic environments, such as the impact of the business cycles (see: Beck et al., 2013), and financial surroundings (Baele et al., 2014; Farooq and Zaheer, 2015). This consequently implies that the financial market downturn in 2006 and the financial crisis in 2008-2009 had an effect on the performance of conventional and Islamic financial system of the GCC countries (Khamis et al., 2010).

With this backdrop, we attempt in this paper to contribute to the determinants of NPL banking literature, in general, and IB in particular, through studying the relationship between bank-level, country-level factors and NPL in the GCC countries. In addition, we examine the impact of the sectoral distribution financing and the distribution of Islamic financial methods on the observed trends of NPL. In doing so, we apply a panel of five GCC countries using GMM, over the period 2005 to 2011. The reason for using the GMM approach is because it allows capturing the accurate dynamic effect that could take place via variables influence NPL (Fiordelisi et al., 2011; Louzis et al., 2012).

This study extends the literature of NPL in four aspects. First, we investigate the relationship between sectoral financing growth and NPL, by using three variables, which are real-estate construction financing, manufacturing-industry of all commercial banks, and real-estate construction financing of IB. Given that the

influence of business cycle that can be captured through several possible indicators, such as credit to the privet sector, house price and equity price (Nkusu, 2011), we believe that our selected determinants do represent the most appropriate indicators to measure the influence of business cycle on NPL of the GCC banking sector. To the best of our knowledge, our paper is one of the first studies to specifically consider the impact of sectoral financing on NPL, using the three above mentioned variables. Second, we measure the linkage between Islamic financing instruments and NPL, by utilising the growth rate of profit-loss-sharing (PLS) contracts variable and fixed-income creating debt (FID) contracts variable. In fact, the nature of financing instruments or contracts in CB differ than IB. Abedifar et al. (2013) and Daher et al. (2015) point out that IB mostly apply non-PLS contracts, because they are not risky as PLS contracts and technically they are similar to CB practices. These variables have not been used before in investigating the determinants of NPL. Third, we test the robustness of our results by using two different approaches; we start with panel data models to check the validity of the country-level and bank-level factors, that contributing to NPL in the IB. Then, we study the link between efficiency and NPL that is introduced by Berger and DeYoung (1997). In the latter fitted approach, we apply data envelopment analysis (DEA) method to obtain more precise efficiency scores. In addition, we check the validity of the obtained efficiency scores through applying stochastic frontier method (SFA) (Berger and Humphrey, 1997). Finally, we consider the GCC region, of 51 banks, including IB and CB. The focus on the GCC countries is particularly due to the expansion of the economies of those countries has resulted in the rapid development of the financial sector elements, including IB. For example, in 2013 the percentage of the global total assets of IB accounted for by the GCC region was 39.2%, compared to 38.6% in non-GCC Middle East countries, 19.6% in Asia, 1.7% in Australia, Europe, and America (The Banker, 2013, November). This development and expansion of IB in the region has contributed to further growth of the bank credit system. Therefore, we believe that it is vital to investigate the impact of such banks on NPL in the GCC region.

Our findings indicate that the growth rates of sectoral financing variables present a relatively similar adverse impact on NPL. Furthermore, the real-estate-construction financing of IB with one-year lag variable suggest that the financing of IB increases the risk exposure. Regarding to our results on the PLS growth, we suggest that despite

the high risk-level in PLS instruments, increasing the PLS financing could lead to a decrease in NPL. However, the financing growth path of FID variable could harm the loan quality more than PLS instruments.

The remainder of the paper is organised as follows. Section 2 provides an extensive survey of NPL literature to put our study in context. Section 3 discusses brief information on banking sector in the GCC. Section 4 presents the data and describes the determining factors of NPL. Section 5 explains the details of econometric methodology used to analyse the determents factors of NPL. The empirical results of the paper are discussed in Section 6. Finally, the conclusion is presented in Section 7.

2. Literature Review

The available body of knowledge on banking indicates that NPL or issues regarding problem loans have been examined from several perspectives. Initially, NPL were utilised as an indicator to reflect asset quality within the relevant literature (see: Meeker and Gray, 1987). Some studies focused on investigating the causes that precipitate a bank's failure, including NPL and efficiency levels, where NPL are considered to be one of the key factors (for example, Demirgüç-Kunt, 1989; Whalen, 1991; Barr and Siems, 1994; Wheelock and Wilson, 1995). The second trend in the literature focused on examining the link between bank performance and efficiency, such as productive and cost efficiency and NPL, by using strategies that included the Granger-causality method to explore the directions of the intertemporal relationship between these elements (Berger and DeYoung, 1997; Podpiera and Weill, 2008; Fiordelisi et al., 2011). The final and recent trends in the literature that are related to NPL seem to concentre on investigating the determinants of NPL within banking sector in the form of macroeconomic and microeconomic factors (Salas and Saurina, 2002; Lu et al., 2005; Espinoza and Prasad, 2010; Louzis et al., 2012). Furthermore, some recent studies have investigated the relationship between NPL or loan loss provisioning, macroeconomic factors, and business cycle (Nkusu, 2011; Beck et al., 2013; Soedarmono et al., 2016).

Among the literature relating to banking studies and on the subject of NPL, Berger and DeYoung (1997) report four significant hypotheses when examining the relationship between NPL, cost efficiency, and equity capital in the US commercial banks, from 1985 to 1994, which are 'bad management', 'bad luck', 'skimping' and

'moral hazard'. It was found that increasing NPL can decrease the measured cost efficiency, which implies that diminishing the reduction in NPL by increasing administration expenses can lead to a decrease in the cost efficiency. On the contrary, NPL are considered to be increasing due to the lower cost effacing, indicating a low level of management. However, Podpiera and Weill (2008) attribute the probability of bank failure and increasing NPL with low level of cost efficiency on management quality only ('bad management' hypothesis) and they, consequently, rejected 'bad luck' hypothesis.

Empirically, a number of papers have investigated the determinants of NPL by utilising dynamic panel GMM methods, for the reason that such methods help to capture the accurate dynamic effect of NPL. For instance, Salas and Saurina (2002) examine the determinants of credit risk within commercial and savings banks in Spain, from 1985 to 1997, including factors related to both macro-level and bank-level variables by using GMM-difference. They concluded that there was a significant variance between commercial and savings banks in terms of financial risk management. For both bank types, they stated that bank-specific variables are, however, useful when utilised as timely warning pointers, such as when approaching net interest margin (NIM) and bank size portfolio diversifications. Another empirical study, which employed GMM method, is by Espinoza and Prasad (2010), who investigate the relationship between NPLs, macroeconomic factors, and some selected bank-level factors of the GCC's banking sector by focusing on non-oil GDP, for the period of 1995 to 2008. Their findings also indicated that bank-level variables can be used as early warning indicators for future problem loans, and they found that non-oil GDP is adversely related to NPL. Another of their findings suggested that the global financial surroundings have an impact on NPL.

By using Granger-causality and GMM methods, Fiordelisi et al. (2011) examine the inter-temporal relationship between NPL and bank efficiency of the European banking sector, which support 'bad management' hypothesis by generating evidence that banks with lower level of efficiency tend to have higher bank risk. However, they find that bi- directional causal relationship between capital and NPL, could be used as an indicator for bank risk. A more recent empirical study is that by Louzis et al. (2012) in the case of Greek banks over the period of 2003 to 2009, which conclude that the problem loans in the banking sector are related to macro-level factors,

including interest rate and unemployment, and subsequently by micro-level factors, especially those that reflect the quality of management, such as the ratio for the return on equity. Djalilov and Piesse (2016) examine the determinants of bank profitability in the early transition countries of Central and Eastern Europe and the late transition countries of the former Union of Soviet Socialist Republics (USSR), through employing GMM model, from 2000 to 2013. It is found that, credit risk increases bank profitability in the early transition countries, while credit risk decreases bank profitability in the late transition countries. Overall, banks in early transition countries are more robust than late transition counties of USSR.

Some studies have focused on examining the impact of macroeconomic and business cycles on NPL. For instance, Nkusu (2011) investigate the relationship between NPL and macroeconomic factors by using two approaches. The first approach is based on single-equation panel regressions, which is utilised to prove that a decrease in the development of macroeconomic factors are linked to increasing NPL. The second approach is that of a panel vector autoregressive, which is used to investigate the dynamic interaction of variables determining NPL towards a shock in the system, with particular focus on the global financial crisis, in 2008 through sample consisting of 26 advanced countries, for the period of 1998 to 2009. It is found that regardless of the causes of problem loans, a significant increase in NPL leads to a rise in the NPL themselves through a linear response that may continue from the first shock up until the fourth year.

In expanding the research on the subject matter, a recent study by Beck et al. (2013) investigate the link between macroeconomic factors and NPL, in 75 countries, from 2002 to 2010, by utilising dynamic panel data model. They conclude that the key factor affecting NPL is GDP growth, meaning that the impact of the global financial crisis, which affects the economic activity of each country, was the most risky factor for bank asset quality. Meanwhile, the concept of NPL or asset quality in those countries is found to be influenced by additional factors, such as exchange rate, share prices, and the lending interest rate.

Among the available studies focusing on examining the determinants of NPL in IB sector, some investigations have explored the efficacy and financial stability of IBs and the CB sectors. For instance, Cihak and Hesse (2010) examine the financial

stability of 77 IB, and 397 CB, via applying z-score as an independent variable that is mainly measured through equity capital, reserves, average return and assets of each bank, by differentiating between banks size. They conclud that small IB appear to be more stable than large IB, as large CB seem to be more stable than large IB. Such study relatively covered a large sample from different 19 banking system; indeed, it did focuses on financial stability and financial risk without taking into account the impact of NPL. However, another example, Rahim et al. (2012) compare the CB and IB in relation to financial stability by employing z-score and NPL as indicators reflecting the financial stability in Malaysia, from 2005 to 2010, through the use of the panel data FE model. Their analysis included some independent variables that related to bank-level, such as asset quality and cost-income ratio, which indicates to efficiency, and macro-level variables, including market share, Herfindahl Index, inflation, and real GDP. Rahim et al. find that the financial stability in IB are somehow more constant than in the case of CB, which were affected significantly by efficiency, the Herfindahl Index, inflation, and real GDP. Nevertheless, they noted that those variables were not particularly significant with financial stability indicators in CB.

Furthermore, Abedifar et al. (2013) investigate bank risk and stability of 118 IB, 81 IW and 354 CB, over the period 1999-2009, through three dependent variables, namely, credit risk, which is measured by loan loss reserve, to pinpoint management quality of loan portfolio. In addition, bank insolvency is used to represent banks' stability, which is measured by z-score. The study also included interest rate, which is proxied by net interest margin, to capture as to whether IB charge a higher rate or lower rate to depositors. It is found that, IB mostly apply non-PLS contracts, which are technically similar to CB practices. In addition, small IB seem to be at lower credit risk and more stable than CB, and IB appear to charge their clients for providing Islamic finance products. Louhichi and Boujelbene (2016) investigate the determinants of NPL in Islamic and conventional banks, from 10 Organization of Islamic Cooperation countries, over the period 2005-2012, through applying GMM system technique and panel vector autoregressive framework. Louhichi and Boujelbene conclude that macro-level and institutional factors have effects in determining NPL, IB differ from CB towards NPL because IB are interest-free banks and they share profit with the investment account holders. However, it is necessary to

investigate credit risk that involves with Islamic finance contracts, in order to improve and innovative risk management in IB.

In terms of the GCC countries, Al-Wesabi and Ahmad (2013) investigate the credit risk of IB, through employing NPL as a proxy for credit risk, for the period 2006-2010. It is found that credit risk is significantly affected by management quality, liquidity, risky assets and GDP, where inflation and interest rate is not found to play an important role in explaining the credit risk of IB. Ashraf et al. (2016) examine the impact of ownership structure and income diversification on financial stability of GCC banks, over the period 2000-2011, through utilising Z-score technique. It is concluded that regardless the type of shareholders' concentration, the relationship between the concentration of ownership and insolvency risk is positive. In addition to that, the income diversification increases the financial stability of banks. However, regulatory system needs to be improved in the region. It should be noted that it is understandable that z-score and related empirical models are used to explore credit risk and financial stability; however, such models do not take into consideration the dynamic impacts on financial stability of the GCC banking sector in general and IB sector in particular. Al-Gasaymeh (2016) examines the determinants of bank efficiency in the GCC region, covering the period 2007-2014, by applying SFA to construct cost efficiency scores and GMM system model to investigate the impact of loan concentration ratio, debt in default, credit risk rating and political risk variables. It is concluded that increasing loan concentration leads to decrease efficiency, besides that political stability plays a vital role to enhance banks' efficiency. However, Al-Gasaymeh has not taken in account the impact of bank type, Islamic or conventional, on banks' efficiency, since banks system in the GCC countries is dual, such matter is vital to be considered in exploring banks' efficiency in this region.

In a recent comprehensive and comparative study, Beck et al. (2013) examine the business orientation, bank efficiency, and stability of IB and CB from 22 countries over the period of 1995 to 2009, utilising NPL as a proxy for asset quality. It is concluded that in general NPL are affected adversely by IB. Beck et al. noted, however, that during the global financial crisis the performance of IB was higher than that of CB in terms of asset quality and capitalisation.

Our study is distinct from other empirical studies, in exploring the NPL of the GCC's commercial banking sector, by examining the link between the growth of sectoral financing, Islamic financing methods or instruments, and NPL or loan quality[1].

3. Overview of Islamic Finance Development

Islamic banking and finance differ from its conventional counterparts in terms of practice of the financial transactions as they avoid several prohibited aspects particularly in interest and uncertainty, which are based on Islamic law principles (El-Gamal, 2006). Therefore, there is a significant difference in applications of lending and investment to acquire the specified level of profit between conventional and Islamic financial institutions. Indeed, Islamic banks offer a range of financial services and products, and most of them are categorized into trade and investment that is based on equity participation, profit, loss and risk sharing between banks and investors (Ayub, 2007; Iqbal and Mirakhor, 2011).

The development of Islamic banking and finance has taken place over the last four decades; the initial experience of Islamic banking began in Egypt in 1963 with the establishment of the Mith Gharm bank. After its closure due to the political reasons, the Nasser Social Bank was established in 1971 as another/the Islamic Bank in Egypt. The aim of this bank was predominantly to finance poor people and small projects. However, these initial experiences drew the attention of policy makers, thus, this culminated in the launch of the Islamic Development Banks (IDB) by the Organization of Islamic Conference (OIC) in 1975, which remains the most significant event in the development of Islamic banking. More importantly, in 1975 the first commercial Islamic bank was initiated in Dubai, namely the Dubai Islamic Bank, with the involvement of businessmen and UAE and Kuwait governments (Iqbal and Molyneux, 2016).

The most vital period in the history of growth of Islamic banking and finance occurred between the mid-1970s and 1990s. These may be due to the following: first, several Islamic financial institutions were established in many Muslim countries all over the world. In addition to this, Islamic finance products were adopted to be offered by a number of multinational conventional banks to consumers. Secondly, the

[1] Some studies utilised NPL as an indicator for loan quality, such as those by Hughes and Mester (1993); see Berger and DeYoung (1997: 853).

development of Islamic finance underwent advancement in aspects regarding its financial modes, transactions and products. More importantly, in the third stage of development, the application of a number of Islamic finance functions and modes were acknowledged from two different international institutions (i.e. International Monetary Fund (IMF) and the World Bank). Also, these institutions published working papers describing the impact of the Islamic banking system in the 1990s. Finally, three countries in the Muslim world, namely, Iran, Pakistan and Sudan, replaced interest from their entire banking system with Islamic finance models (Iqbal and Molyneux, 2016) in steady steps At present the number of commercial and investment Islamic banks around the world has increased to reach more than 75 countries (Ayub, 2007). For instance, according to The Banker in 2016 the total sharia compliant assets of financial institutions in the Middle East and North African (MENA) countries has increased from $250 billion, in 2006, to more than $1100 billion, in 2016. Moreover, in the GCC countries the total sharia compliant assets has risen from more than $120 billion to about $720 billion, between the period of 2006 and 2016 (The Banker, 2016, November).

Several institutions are established to provide strength to the development and growth of Islamic banking and finance, based on the perspectives of regulation, liquidity and accounting. Those institutions include Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI) started 1991, International Islamic Financial Market (IIFM) established 2002, Liquidity Management Centre (LMC) launched 2002, and finally Islamic Financial Services Board (IFSB), which was also sat up in 2002. In addition, in 1999 Dow Jones Islamic Market World Index was initiated to produce standards and tools for investors and decrease sharia compliant research expenses. Dow Jones Islamic indexes as well as Financial Times Stock Exchange (FTSE), which have launched a number of Islamic indicators by tracking approximately 2000 international companies which meet the Islamic law principles for investors (Iqbal and Molyneux, 2016; Ayub, 2007).

Islamic finance products are not just used by Islamic banks but these are also used by conventional banks. Many of these conventional banks have offered Islamic financial services particularly in the Middle East region. Conventional banks in non-Muslim countries and communities also have offered Islamic finance products for its consumers. In the European region, Britain is considered as a centre and main leader

in fostering Islamic finance, several Islamic financial institutions, including five Islamic investment banks, are permitted by Financial Service Authority (FSA), such as Islamic Bank of Britain, European Islamic Investment Bank and Gatehouse Bank. Despite such developments, there are some challenges. For instance, Islamic finance institutions suffer inappropriate regulatory regime, and the shortage in innovation and developing their products remains an important area of development but also a challenge.

4. The Banking Sector and Trends of NPL in the GCC Countries

The oil boom in the GCC countries has had a significant impact on the development of the banking sector, although development trajectories have taken several stages, this section only intends to highlight the role of the banking sector in the GCC region. For instance in 2010, the total assets ratio of the banking sector to GDP in Bahrain, where accounted for 224% of the GDP, which has taken first place among the other countries, and the statistics emphasise Bahrain's heavy dependency on its financial sector. For Kuwait, its banking assets represented 131% of the GDP; the UAE, Qatar and Saudi Arabia exhibited commercial banking assets of approximately 122%, 94% and 80% of the GDP, respectively (Alandejani and Asutay, 2015).

In terms of bank type, the region's financial system is dominated by three type of banking, namely IB, hybrid banks in the form of providing Islamic banking through IW and acting as CB, and CB. Alandejani and Asutay (2015) indicate that assets share to total assets of IB account for 19%, with sixteen IB; the assets of IW represent the largest portion of assets at around 56% with eighteen banks; and the assets for CB represent 25% of the total banking activity in twenty banks within the GCC region.

It should be noted that the estimates is based on the GCC countries including Bahrain, Kuwait, Qatar, Saudi Arabia, and the UAE but excludes Oman, as Oman's Islamic banking and finance sector can only traced back to three years.

Insert Figure 1

As for the developments and trends in the NPL in the region, Figure 1 depicts the trends in NPL as a ratio of GDP in each country. As can be seen, NPL ratio increased sharply with the exception of Qatar, and it reached its peak in 2009. In particular, in the case of the UAE, it reached its peak in 2009, which can be explained by the impact of the global financial crises as the UAE is considered as the most financialised country in the region. As indicated in the figures, NPL rose significantly in Kuwait during 2009 because of real estate financing and equities. In addition, from the perspective of an individual bank, the Gulf Bank in 2008 had higher losses due to derivatives transactions linked to clients. In the UAE, during 2009, NPL has increased, one of the main reason of this increase is that the Central Bank authorised instructions to classify loans to the Saudi Arabian conglomerates, namely Algosaibi and Al-Saad groups, as bad-loans (Khamis et al., 2010: 5). However, the impact of global financial crisis should also be considered in the increase of the NPL, as Dubai, one of the Emirates of the UAE, went through financial difficulties and was bailed out by Abu Dhabi.

With regards to the GDP trends, as can be seen in Figure 1, the real GDP growth declined dramatically in 2009 without exception, especially in Kuwait and the UAE. The initial observations from the panel of figures in Figure 1 indicate that GDP growth comparatively diminishes NPL.

When reflecting on the economic realities of the region, it should be noted that the non-oil GDP growth could have a significant impact on NPL in the GCC banks, for oil prices in the Gulf countries have remained constantly high over the period from 2005 to 2010 and have steadily increased the revenues (Khamis et al., 2010: 6). In support of the previous statement, Espinoza and Prasad (2010) argue that non-oil GDP would be a better selection criterion for NPL, given that the oil companies are owned by the state and loans are therefore not defaulted by them. In addition, the oil revenues spread to the non-oil channels in the economy, such as through public spending and household expenditures; they thus claimed that it would be better to investigate this impact through the real non-oil GDP growth. Consequently, the increase in non-oil real GDP is expected to result in a decline in NPL, meaning that the relationship

between these two variables is expected to be negative[2]. In general, NPL are systematically affected by macroeconomic performance and business cycles (Nkusu, 2011).

As regards to the breakdown of Islamic financing modes, It should be noted that the aggregate PLS contracts which are operated by IB in the GCC is relatively small when compared with FID instruments, as there is a strong preference for FID due to their less risky nature. For instance, in 2011 the PLS contracts in total Islamic financing contracts accounted for 0.6%, 9.9%, 6.2%, and 2.3%, respectively, in Saudi Arabia, the UAE, Bahrain, and Qatar. Thus, IB prefer to operate through cost-plus sale or FID instruments as a substitute to credit and loans in CB (Hassan and Lewis, 2007; Ayub, 2007; Ahmed, 2011).

Insert Figure 2

As displayed in Figure 2, the PLS financing to total financing for IB has not even reached 18% in the UAE; the lowest percentage appears in Saudi Arabia IB with about 1%. In comparison, Figure 3 depicts the share of FID transactions in the total financing for each country.

Insert Figure 3

As can be seen in Figure 3, the share of FID generally fluctuated between 85% and above, which implies that IB in the GCC countries have heavily relied on FID type financing instruments, particularly *murabahah* financing. From the financing portfolios in IB, it can be noted that the managers in IB do avoid higher levels of risk. Even in the presence of well-monitored credit policy, these IB may control the default loans by increasing the admission fees in such transactions. This action ultimately could have a negative impact on businesses cycle and real GDP growth, which may then increase the NPL. Although FID contracts are more favourable in the operations

[2] The non-oil real GDP growth variable is taken from The Economist Intelligence Unit reports, through the real change in origin of GDP (%) in all sectors with the exception of industry, because this sector is heavily dependent on oil and petrochemical companies.

of IB than PLS modes due to the less risky nature of these instruments, the impact of the former group could be positive with NPL, whereas the directional nature of PLS contracts on NPL cannot be predicted.

5. Describing the Determinants of NPL

After an extensive review of the available literature, the variables used in this study are defined when forming the empirical models to be tested. Based on the available literature, the variables used in empirical models in this study are classified as macroeconomic variables, organisational - and structure - oriented variables, product-development-related variables, and bank-level variables.

The relationship between the macroeconomic environment and NPLs is investigated by a number of studies in banking literature (see: Salas and Saurina, 2002; Louzis et al., 2012), which include variables such as the real GDP growth, non-oil GDP growth, sectoral financing, organisational structure, and product-development factors. By reflecting on these factors, this study considers the following variables:

Growth of financing for the real estate and construction sectors by at CB;

Growth of financing for the manufacturing and industry sectors by CB;

Asset growth of CB;

Fully-fledged IB financing growth for the real estate and construction sectors;

Growth in the assets size of fully-fledged IB and IW;

The growth of *Shari'ah*-compliant assets in IB and IW;

The growth of profit-loss-sharing (PLS) financing;

The growth of fixed-income creating debt (FID) financing.

The next factor, which is considered to have a determining impact on NPL, is that of bank structure and organisational development, which is in turn related to the bank type. Table 1 presents the definition of the variables used, which include the growth rate of assets size of fully-fledged IB, IW, and CB, as well as hypotheses suggested to be tested. The link between the ratio of NPL and each of these variables is unclear in terms of its direction. Salas and Saurina (2002) and Louzis et al. (2012) stated that

bank size itself, without the growth rate, indicates a risk of diversification, implying that bigger banks have significant potential for additional opportunities in diversification, which is associated negatively with NPL. Such variables can therefore be utilised as a proxy to assess the link between the growth rates for each bank type. This notion is particularly true if they differ in risk-taking behaviour to diversify their portfolios between high-risk projects and low-risk projects with more conditions and restrictions, where a negative link with NPL signifies a lower risk of diversification in contrast to a positive relationship with NPL, which indicates a higher risk of diversification.

The last factor is product development, which is associated with the allocation of type of Islamic financing (IF) contracts according to their categories, which are PLS and FID types of financings. As is recognised in Islamic finance literature, PLS modes of financing include *mudarabah* and *musharakah*, while FID contracts are comprised of *murabahah* (mark-up pricing), and deferred sales, such as *ijarah* or leasing and hire purchase, *salam* and *istisna*[3]. It is essential for this study to investigate the influence of the financing of IB through both PLS and FID instruments on NPL. The growth rate of each category in each country is calculated in order to examine the effect of these variables.

After discussing the potential macro-level, organisational, structural, and product-development-related determining factors of NPL as envisaged by the theoretical framework, this section focuses on micro-level or bank-specific factors, which include RWA, two selected financial ratios (ROE and NIM) to reflect upon the indicators of a bank's profitability, and efficiency scores.

[3] In the current study sample, Kuwait's IBs, including the Kuwait Finance House, the Kuwait International Bank and the Boubyan Bank KSC, have not provided any *PLS* contracts. Again, in this study sample and over the observed period, it is located that none of the *IBs* have utilised a *salam* contract except Dubai Islamic Bank, which used this instrument for the period of 2010 to 2011 with 2.45% and 6.15% of total Islamic financing modes.

Table 1: Definition of Variables and Hypotheses

Variable	Definition	Hypothesis Tested
NPL	NPL to gross loans (dependent variable NPL)	The prior NPL put more load on the current NPL (+)
RWA	Risk-weighted assets to total assets	Credit risk capture (+)
ROE	Return on equity = $\frac{\text{Profits}_{it}}{\text{Total equity}_{it}}$	Bad management (-)
NIM	Net interest margin = $\frac{\text{Profit margin (after excluding interest expenses)}_{it}}{\text{Average of earning assets}_{it}}$	Risky loan portfolio (-)
EFF^{DEA}	Efficiency scores obtained from DEA	Bad management, bad luck (-) and skimping (+)
EFF^{SFA}	Efficiency scores obtained from SFA	Bad management, bad luck (-) and skimping (+)
ΔGDP	Real growth of Gross Domestic Product	Prosperity (-)
$\Delta\, non-oil\ GDP$	Non-oil GDP growth	Prosperity (-)
ΔIM	Manufacturing and industry financing growth	Interaction with business cycle and real GDP (-)
ΔREC	Real estate and construction of GCC banks financing growth	Interaction with business cycle and real GDP (-)
$\Delta RECIB$	real estate, and construction financing growth of IB	Interaction with business cycle and real GDP (-)
ΔIBA	Fully-fledged assets of IB to total assets growth	Less risk in diversification (-), high risk in diversification (+)
ΔIWA	Islamic window assets to total assets growth	Less risk in diversification (-), high risk in diversification (+)
$\Delta IBIWA$	IB and Islamic window assets to total assets growth	Less risk in diversification (-), high risk in diversification (+)
ΔCBA	CB assets to total assets growth	Less risk in diversification (-), high risk in diversification (+)
ΔPLS	PLS contracts financing to total Islamic financing growth	Less concentrated in transactions of IB (Unknown)
ΔFID	FID contracts financing to total Islamic financing growth	More concentrated in transactions of IB (+)

With regard to RWA to gross total assets ratio, the RWA captures the credit risk of bank portfolios when considering some aspects such as the sort of debtor and the actual collateral and guarantees. It is measured according to the Basel II Accord, which provides definite requirements, including lending policies from bank regulators. Repullo and Suarez (2013) suggest, however, that the capital buffers under Basel II are not sufficient to counteract any recession on the supply of credit to bank

debtors. In addition, De Lis et al. (2001) highlight that credit is likely to rise faster during expansion and slower during recession than GDP. Such arguments demonstrate key evidence as to the effects of financial crises and downturn on the business cycle, wherein RWA increases because it utilises the capital buffers as one of the requirements in Basel II; a rise in this ratio leads to an increase in the present or future value of NPLs. The link between RWA ratio and NPL is shown by Berger and DeYoung (1997) to be positive, given that increasing the credit risk in bank portfolios leads to an increase in NPL. Therefore, the relationship between RWA and NPL is predicted to be positive.

Turning to performance and profitability ratios (including ROE and NIM), the ROE reflects the management quality, which is found to be negatively related to NPLs in the study by Louzis et al. (2012), which pointed out that due to the previous performance of bank management a negative link between ROE and NPL could be seen, which is indicative of 'bad management' hypothesis. In the short term, the ROE ratio may, however, have a positive relationship with NPL; for example, the bank may elevate the existing earnings at the cost of upcoming defaulted loans to enhance the profitability aspect in a market by utilising loan-loss provisions; such a credit policy is named a liberal policy or 'pro-cyclical or lending policy' (see: Gordy and Howells, 2004; Louzis et al., 2012; Repullo and Suarez, 2013; and Adrian and Song Shin, 2014). It should be noted that in this study ROE ratio is examined in non-dynamic panel static models and in a dynamic model reflecting the effect of the previous year, which is expected to have a negative sign in its relations to NPL.

The NIM ratio is based on the annual margin profits, which are attained from the difference between interest income and expenses dominated by earning assets (Golin and Delhaise, 2013). Salas and Saurina (2002) state that if NIM has declined then the credit diversification policy could be modified, and these changes can make loan portfolios more risky, which in turn increases the probability of defaulted loans. The sign of this variable with no lag is unpredictable, yet with one lag the NIM ratio is anticipated to be negative with NPL.

Since a bank is considered to be an intermediary between investors and borrowers that transforms the input of monetary sources to output quantities or products (see: Berger and Humphrey, 1997), the selected input-output variables to estimate efficiency

scores are total deposits, short-term funding (DSF), and operating expenses (OE), including non-interest and personal expenses; the output variable is net loans (NL) (see: Yudistira 2004; Bouchaddakh and Salah, 2005; EI-Gamal and Inanoglu, 2005; Sufian, 2006; Bader et al. 2008; El-Moussawi and Obied, 2010).

In this study, bank efficiency is examined to detect how efficient the banks are at producing loans and, most importantly, to examine the relationship between efficiency and NPL. This in turn is instigated to investigate the management behaviours when directing NPL, which can be explained by 'bad management', 'bad luck', and 'skimping' hypotheses developed by Berger and DeYoung (1997). In the case of the 'bad management' and 'bad luck' hypotheses, the relationship between bank efficiency and NPL is negative for several reasons. For example, with the former hypothesis as an internal cause, the absence of management quality in monitoring loans expenses and collateral, results in decreasing the efficiency and increasing loan problems. The state of the 'bad luck' hypothesis is held due to external factors, such as a downturn in the macroeconomic aspects which may create additional costs in administrating NPL, which instils an adverse effect on bank efficiency. On the other hand, the 'skimping' hypothesis indicates a positive relationship between efficiency and NPL. In the 'skimping' policy position the bank tends to reduce the administrative expenses that are related to monitoring and controlling borrowers; such a procedure thus makes the bank efficient and the NPL appear to be not effected, especially in the short term. Over time the loan performance problem does, however, appear because of defaulted loans as a large number of debtors become negligent. In the present study the influence of a bank's efficiency on NPL is also investigated in the present and on previous occasions. As noted by Berger and DeYoung (1997), a bank may be affected by all of these three hypotheses. For instance, 'bad luck' could occur as a result of economic crisis; at the same time bank management may make bad decisions by adopting a skimping policy to reduce costs; all of these procedures could result in an increase in NPL.

6. Model Selection and Empirical Process

After presenting the literature review of the available empirical studies and identifying the potential variables used and will be used in this study in exploring and examining NPL, this section focuses on model selection and empirical process.

6.1. Dynamic Panel Data (GMM) Estimator

The dynamic panel approach or GMM models are utilised to estimate the factors that may determine NPL over time, which is proposed as GMM difference (GMM-DF) model developed by Holtz-Eakin et al. (1988) and by Arellano and Bond (1991); and GMM system (GMM-SYS) model, which is developed by Arellano and Bover (1995). After that, estimating efficient dynamic panel models for a small number of time-series observations or longitudinal data, which is proposed by Blundell and Bond (1998).

The general description of the dynamic panel model is defined in the following equation:

$$y_{it} = \alpha y_{i,t-1} + \beta(l)x_{it} + \eta_i + \nu_{it}, |\alpha| < 1 \quad (1)$$

where $\beta(l)$ symbolises the lag of estimate parameters; α represents the coefficient of the lagged dependent variable; x_{it}, η_i, and ν_{it} are described in the previous part related to panel data.

The GMM model is based on the first difference transformation of equation 1, which can be rewritten as:

$$\Delta y_{it} = \alpha \Delta y_{i,t-1} + \beta(l)\Delta x_{it} + \Delta \nu_{it} \quad (2)$$

where Δ signifies that the first difference operator component and ν_{it} component are not correlated over time [($E(\nu_{it}\, \nu_{i,t-1}) = 0$]. The dependent variable with one lag, $\Delta y_{i,t-1}$, is correlated with error term $\Delta \nu_{it}$, leading to a biased estimation of the model. The dependent variable with two lag or more, $\Delta y_{i,t-2}$, is, however, correlated with $\Delta y_{i,t-1}$ and not with $\Delta \nu_{it}$, which can be used as an instrument variable of equation three. This then proceeds to the orthogonality restrictions description, starting with the following equation of moment conditions:

$$E(y_{i,t-s}\Delta \nu_{it}) = 0 \; for \; t = 3, \ldots, T \; and \; s \geq 2 \quad (3)$$

The second case of moment conditions when exploratory variables are *strictly exogenous*, which implies that over all time those variables are not correlated with the error term, as in the following formula:

$$E\left(x_{i,t-s}\Delta v_{it}\right) = 0 \; for \; t = 3, \ldots., T \qquad (4)$$

For the case when explanatory variables are weakly exogenous or predetermined, such as $E(x_{it}v_{it}) \neq 0 \; with \; t < s$, then the x_{it} can be a valid instrument only with the specified lagged values, which involves the moment conditions as follows:

$$E\left(x_{i,t-s}\Delta v_{it}\right) = 0 \; for \; t = 3, \ldots., T \; and \; s \geq 2 \qquad (5)$$

If Z_i is the matrix element of instrumental variables then according to Bond (2002) the equation (5) can be rewritten as:

$$E(Z'_i \Delta v_{it}) = 0 \qquad (6)$$

The GMM model is built on moment conditions that diminish the criterion as expressed in the following equation:

$$J_n = \left(\frac{1}{n}\sum_{i=1}^{n} \Delta v'_i z_i\right) W_n \left(\frac{1}{n}\sum_{i=1}^{n} z'_i \Delta v_i\right) \qquad (7)$$

By utilising the weight matrix:

$$W_n = \left[\frac{1}{n}\sum_{i=1}^{n}(z'_i H z_i)\right]^{-1} \qquad (8)$$

where *H* is an individual specific matrix. The previous equations (3 and 8) form the basis of the GMM one-step estimator, which is efficient if the error terms are homoscedastic. Indeed, there are two types of GMM estimators: one-step and two-step estimates. In addition, Windmeijer (2005) pointed out that the GMM two-step estimate with corrected errors asymptotically could achieve better results than the one-step estimator. The data sample of this study is, however, relatively small; the one-step GMM model is therefore preferred in the present study. Thus, in such a sample, the standard errors do not allow for additional variations to construct the weight matrix (Bond, 2002; Bond and Windmeijer, 2005; Windmeijer, 2005).

In order to examine the autocorrelation, the Arellano-Bond approach is utilised with first-order (AR1) and second-order (AR2) serial correlation; the former is applied to detect the serial correlation in differenced error terms when given the following:

$$\Delta v_{it} = v_{it} - v_{i,t-1} \text{ , and} \qquad (9a)$$

$$\Delta v_{i,t-1} = v_{i,t-1} - v_{i,t-2} \quad (9b)$$

Both equations 9a and 9b share the $v_{i,t-1}$ term. The later test is used to check the serial correlation in levels for first-order. Further, Sargan & Hansen joint tests are applied and reported after the GMM estimation to indicate the validity of instrumental variables with the objective of making sure that they are not endogenous to the differences of the error term[4].

In addition to applying the difference GMM estimator, this study applies the GMM system estimator; the latter differs from the former by exploiting additional moment conditions, $T-2$, to the moment conditions in the first differences model. Blundell and Bond (1998) stated that the performance of the GMM system estimator could be less biased and more accurate, especially if α is large. The form of this estimator can be written in the following equation:

$$E\left(u_{it}\,\Delta y_{i,t-1}\right) = E\left((\eta_i + v_{it})\Delta y_{i,t-1}\right)$$

$$= E\left(\left(y_{it} - \alpha y_{i,t-1}\right)\Delta y_{i,t-1}\right) = 0 \quad (10)$$

6.2. Econometric Specification

As presented above, Table 1 describes the utilised variables that may impact and determine the *NPLs* of the GCC banks, starting with the basic estimate model:

$$NPL_{it} = \alpha NPL_{i,t-1} + \sum_{k=0}^{1}\beta_{1k}RWA_{it-k} + \sum_{k=0}^{1}\beta_{2k}\Delta GDP_{it-k} + \eta_i + v_{it}, \quad \text{and}$$

$$|\alpha| < 1, i = 1, \ldots,51, t = 1, \ldots,7 \quad (11)$$

where NPL_{it} denotes the average of impaired or default loans to gross loans per year, which represents the ratio of NPL to gross loans; this is suggested by Louzis et al. (2012)[5]. The estimated α of $NPL_{i,t-1}$ should be positive; RWA measures the ratio of

[4] Some lags are invalid as instruments; for example, if $y_{i,t-2}$ as an instrument is endogenous to the differences in the error term that leads to an invalid instrument (Roodman, 2009).

[5] Many studies employed the transformed variable through truncated or logit transformation of NPL ratio as dependent variable (for example, Salas and Saurina, 2002 and Espinoza and Prasad, 2010). The present study does, however, utilise the numeral of *NPL* ratio without transformation because it shows

RWA to total assets. This variable is utilised under the assumption of weak exogeneity with bank-level factors, which indicates that endogeneity and potential correlation matter with error term over time (Salas and Saurina, 2002; Louzis *et al.*, 2012). To avoid the correlation problem, such a variable is therefore computed with two lags or more for the first difference transformed form in equation 1. The last variable in the basic estimate model is that of real GDP growth rate, and although ΔGDP is assumed to be strictly exogenous, the GDP growth and the other additional variables (treated as predetermined) in the following models are instrumented by themselves 'IV-style' (Roodman, 2009).

A selection of variables was added to the basic model to account for the micro - and macro - level factors; initially, this is to investigate the relationship between bank efficiency and NPL in the effects on the present and previous year. It is worth noting that those selected variables are estimated in different equations, due to the number of observations, which is relatively small and turns to cause technical and statistic problems. The following equation is estimated:

$$NPL_{it} = \alpha NPL_{i,t-1} + \sum_{k=0}^{1} \beta_{1k} RWA_{it-k} + \sum_{k=0}^{1} \beta_{2k} \Delta GDP_{it-k} + \beta_{3k} {EFF^{DEA,SFA}}_{it} + \sum_{k=0}^{1} \beta_{4k} {EFF^{DEA,SFA}}_{it-k} + \eta_i + \nu_{it} \quad (12)$$

where $EFF^{DEA,SFA}$ separately represents the efficiency scores that are computed by utilising the output distance function via the DEA under variable return to scale assumption. In addition, to rationalise the efficiency scores that are obtained through the DEA method and to conduct the robustness check, the stochastic frontier approach (SFA) is utilised by applying Cob-Douglas production function (see chapters two and three). After that and to examine the non-oil GDP growth impacts on NPL, the following formula is estimated:

$$NPL_{it} = \alpha NPL_{i,t-1} + \sum_{k=0}^{1} \beta_{1k} RWA_{it-k} + \sum_{k=0}^{1} \beta_{3k} {\Delta GDP^{nonoil}}_{it-k} + \eta_i + \nu_{it} \quad (13)$$

In addition, in order to test the hypothesis of a bank's profitability effect on NPL, bank-level variables are included with the basic model as follows:

$$NPL_{it} = \alpha NPL_{i,t-1} + \sum_{k=0}^{1} \beta_{1k} RWA_{it-k} + \sum_{k=0}^{1} \beta_{2k} \Delta GDP_{it-k} + \sum_{k=0}^{1} \beta_{3k} {x^h}_{it-k} + \eta_i + \nu_{it} \quad (14)$$

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more significant and precise results. Furthermore, Salas and Saurina (2002) pointed out that the transformation of dependent variable would not be suitable for the GMM process.

where x^h represents bank-level variables, which are ROE and NIM. Accordingly and corresponding to the impact of bank-type and assets-size on NPL, other variables related to banking-sector development are tested in the econometric specification, which is written as:

$$NPL_{it} = \alpha NPL_{i,t-1} + \sum_{k=0}^{1} \beta_{1k} RWA_{it-k} + \sum_{k=0}^{1} \beta_{2k} \Delta GDP_{it-k} + \sum_{k=0}^{1} \beta_{3k} \Delta x^{z}{}_{it-k} + \eta_i + \nu_{it} \quad (15)$$

where Δx^z denotes the asset growth of *IB*, *IW*, and *CB*.

The equation 16 captures the dynamic effect of construction and real-estate sector financing for IB and CB on NPL:

$$NPL_{it} = \alpha NPL_{i,t-1} + \sum_{k=0}^{1} \beta_{1k} RWA_{it-k} + \sum_{k=0}^{1} \beta_{2k} \Delta GDP_{it-k} + \sum_{k=0}^{1} \beta_{3k} \Delta x^{r}{}_{it-k} + \eta_i + \nu_{it} \quad (16)$$

where Δx^r symbolises the growth of the real estate and construction aspects of the financing for IB and CB.

Finally, in terms of Islamic finance modes, it is essential for this study to examine the relationship between NPLs and Islamic finance contracts, such as PLS contracts and FID contracts. Thus, the following equation aims to investigate such a dynamic relationship between those variables:

$$NPL_{it} = \alpha NPL_{i,t-1} + \sum_{k=0}^{1} \beta_{1k} RWA_{it-k} + \sum_{k=0}^{1} \beta_{2k} \Delta GDP_{it-k} + \sum_{k=1}^{2} \beta_{3k} \Delta IFM^{PLS,FID}{}_{it-k} + \eta_i + \nu_{it} \quad (17)$$

where $\mathrm{IFM}^{\mathrm{PLS,FID}}$ denotes the individual change in PLS and FID contracts.

6.3. Data and Sample

The annual financial statements of 51 banks, including *IB*, *IW* and *CB*, from all the GCC countries, namely Bahrain, Kuwait, Qatar, Saudi Arabia and the UAE (with the exception of Oman due to the absence of Islamic banking in the country for the period in question), for seven years from 2005 to 2011 were acquired from Bankscope under the International Accounting Standard (IAS) in US dollars. It should be noted that foreign banks that have branches, which operate, in the GCC region are excluded from the sample.

The sampled banks are therefore limited to fourteen domestic IB and thirty-eight domestic CB, which are comprised of:

(i) Two IB and two CB that provide Shari'ah-compliant windows or IW, and three CBs in Bahrain;

(ii) Three IB and five CB in Kuwait;

(iii) Two IB and four CB that provide Shari'ah-compliant window or IW, and one conventional bank in Qatar;

(iv) Three IB and nine CB that provide Shari'ah-compliant windows or IW in Saudi Arabia;

(v) Four IB, three CB that provide Shari'ah-compliant windows or IW, and eleven CB in the UAE.

Table 2 displays the summary descriptive statistics of the variables.

Table 2: Descriptive Statistics of Variables

Variable	Mean	St. Dev.	Min.	Max.
Dynamic panel data (GMM) of all banks				
NPL	4.90	7.60	0	56.86
RWA	72.27	24.99	0	133.37
ROE	12.03	55.94	-946.11	52.77
NIM	3.49	1.37	1.2	13.53
DSF	17048.6	19062.6	98.40	103478
OE	1069.52	4524.00	4.50	39960.1
NL	13284.2	15251.5	50.68	89608.5
lnDSF	9.051	1.332	4.589	11.55
lnOE	5.258	1.45	1.504	10.60
lnNL	8.84	1.312	3.997	11.46
EFF^{DEA}	62.17	17.08	5.38	100
EFF^{SFA}	81.98	6.79	38.24	96.80
Δ*IBA*	5.19	16.33	-17.43	70.83
Δ*IWA*	71.92	147.40	-14.25	709.70
Δ*IBIWA*	13.46	27.49	-10.74	143.13
Δ*CBA*	-0.50	2.30	-6.68	9.25
Δ*RECIB*	47.52	39.82	-26.23	135.60
Δ*REC*	31.21	28.15	-9.64	98.25
Δ*IM*	23.45	25.77	-16.11	134.80
Δ*PLS*	174.10	936.62	-46.34	5415.93
Δ*FID*	-0.318	2.231	-8.653	5.191
Δ*GDP*	5.52	5.16	-5.2	18.6
Δ*Non-oil GDP*	6.37	8.60	-7.2	36.1

Notes: DSF, OE, NL and the natural logarithm of their number (ln) are utilised to compute efficiency scores; they are presented in USD million. The minimum ratio of ROE is shown by the Gulf Bank (KSC) in Kuwait during 2008.

In addition, all of the annual variables utilised to compute efficiency scores are converted to suitable real prices according to the GDP deflator in 2005. Other micro- and macro-economic variables are drawn from the Economist Intelligence Unit, the

Islamic Research and Training Institute (a member of the Islamic Development Bank) through its website, the World Databank through the website of the World Bank Group, and The Banker (various issues).

7. Results and Discussion

7.1 GMM Results

The GMM analysis is conducted to analyse the obtained findings that describe the relationship between NPL and the independent variables, which are bank-level and macro-level variables, including the impact of Islamic financing on NPL in the GCC commercial banks, by estimating five models. These models include OLS, two-stage least squares (2SLS), FE panel data, GMM-difference, and GMM-system. All of these econometrics specifications are utilised in order to check the robustness test for each of the estimated coefficients in terms of direction and statistical significance[6]. In addition, the Arellano-Bond *p*-values test of autocorrelation[7]. All of these *p*-values are reported in all of the estimated models, along with the *p*-value of the Hansen test, which is estimated for the validity of instrumental variables.

In this model, NPL and RWA are utilised as endogenous bank-level variables via 2SLS and GMM estimates with two and three lags. Thus, in the 2SLS estimate, the NPL-dependent variable with one lag is instrumented. Although in the GMM estimates (as described in section 4), RWA is assumed to be a weak exogenous bank-level variable, meaning that the decision-makers of a bank's management take into consideration the future expected amount of NPL; the other independent variables that related to macro-level are treated to be under predetermined assumption. Variables associated with bank-specific or micro-level factors are therefore predetermined

[6] 2SLS is preferred in order to maximise the sample size, especially in the case of short panel, with levels estimator through Anderson and Hsiao (1981) estimator, because of the instrumental variable is instrumented with lags rather than differences (Roodman, 2009: 105-106).
Again as reported for panel data estimates, a multicollinearity problem is detected through VIF in all dynamic estimators and it is found that for each explanatory variables the value of VIF is less than 1.30, with the exception of efficiency scores as the values of VIF are about 4.50 for DEA estimate and around 2.80 for SFA estimate; this indicates that there is no multicollinearity (Greene, 2007: E5-18). The test is shown in the appendix.

[7] Namely AR(1) for first-order, is conducted to detect the correlation of residuals through the differences in error terms, which must be less than 1% to reject the hypothesis that the random error process is correlated through individual, and AR(2) for second order is estimated to test the autocorrelation in first-order levels. The *p*-value here must be more than 10%, thus, to accept the hypothesis that error terms are autocorrelated as a full distribution but not through levels, *see* Roodman (2009:119-121).

(Salas and Saurina, 2002; Louzis et al., 2012). In other words, they are instrumented by themselves 'IV-style' (Roodman, 2009).

In all estimated models from four to twenty, the coefficient of the lagged dependent variable is positive and statistically significant in most of these models, which have a coefficient of less than one, which is in line with Salas and Saurina's (2002) study. Such findings imply that NPL are likely to be increased due to previous NPL.

In Table 3, Model 1 and Model 2 represent the baseline specification and the estimator model, including non-oil GPD growth as an independent variable. The baseline estimate shows a significant *p*-value of first-order autocorrelation and no serial correlation in the second-order, implying that the estimators are consistent; the Hansen test confirms the hypothesis that the instrumental variables are valid. The coefficients of explanatory variables have the anticipated sign, and they are significant in all estimators with the exception of the coefficient of GDP growth in the GMM-system estimator. The *p*-value of second-order serial correlation suggests, however, that the GMM estimators of Model 2 are not consistent; the findings of this model therefore cannot be relied on.

By looking at all of the estimators of variables for RWA and GDP in Table 3, it can be seen that the coefficient of RWA is positive with not more than 0.18 and that is significant in most specifications. The implication of this variable is that NPL are likely to increase due to increasing the previous credit risk of banks' portfolios. In terms of macroeconomic variables, as can be seen from the results, the GDP coefficient is negative and significant in several models, suggesting that a rise in the real GDP growth in the previous year leads to a decrease in the NPL from 10% to 20%. In addition, the relationship between the lagged variable of non-oil GDP growth and NPL is negative; it is also in line with the expectations of this study, yet this result could be biased and misleading.

In terms of bank-specific variables, Table 4 depicts the results of Model 3 and Model 4 for bank level financial ratios. As the results indicate, according to the *p*-values of AR(1) and AR(2) and the Hansen test, it is presumed that both models are consistent at 10% for AR(1) in GMM-system model; the instrumental variables are also valid. The coefficient of the performance variable, namely ROE, is negative and significant

with NPL at about 2%, which is in line with the expectations of this study. This result implies the presence of previous bad decisions on the part of bank management, which prompts a decrease in bank performance and thus results in an increase of NPL. Likewise, the profitability ratio NIM has a negative and significant impact of approximately 2% on NPL, suggesting that the modification in credit policy due to the previous decline in NIM could raise the risk-level in the loans portfolio, which in turn increases NPL.

Table 3: Baseline Model (Model 1) and Estimated Model (Model 2)

	Model 1 (Baseline estimate)					*Model 2*				
Variables	*OLS* *NPL*	*2SLS* *NPL*	*FE* *NPL*	*GMM-DF* *NPL*	*GMM-SYS* *NPL*	*OLS* *NPL*	*2SLS* *NPL*	*FE* *NPL*	*GMM-DF* *NPL*	*GMM-SYS* *NPL*
NPL_{-1}	0.934***	0.948***	0.509***	0.427**	0.925***	0.946***	0.954***	0.946***	0.521***	0.933***
	(0.027)	(0.054)	(0.124)	(0.197)	(0.0501)	(0.0225)	(0.0529)	(0.0225)	(0.188)	(0.0468)
RWA_{-1}	0.0179**	0.0174*	0.034***	0.0652**	0.084***	0.0182**	0.0156*	0.0182**	0.083***	0.084***
	(0.008)	(0.0087)	(0.0082)	(0.0328)	(0.0241)	(0.0082)	(0.0085)	(0.0082)	(0.0309)	(0.0238)
ΔGDP_{-1}	-0.08***	-0.065**	-0.16***	-0.16**	-0.0494					
	(0.025)	(0.0277)	(0.0484)	(0.0671)	(0.0379)					
$\Delta non-oil\ GDP_{-1}$						-0.060**	-0.068**	-0.060**	-0.064**	-0.047*
						(0.0245)	(0.0303)	(0.0245)	(0.0266)	(0.0245)
Constant	-0.134	-0.0936	1.049		-5.15***	-0.274	0.118	-0.274		-5.23***
	(0.69)	(0.821)	(0.814)		(1.997)	(0.702)	(0.886)	(0.702)		(2.000)
Observations	283	232	283	232	283	283	232	283	232	283
R-squared	0.825	0.805	0.346			0.826	0.808			
Number of banks			51	50	51			51	50	51
No. of instruments				31	42				31	42
Hansen test p-value				0.29	0.41				0.13	0.29
A-B AR(1) test p-value				0.00	0.07				0.01	0.08
A-B AR(2) test p-value				0.17	0.17				0.08	0.12
IV-2SLS	Instrumented: NPL_{-1} Instruments: $RWA_{-1}\ \Delta GDP_{-1}\ NPL_{-2}\ RWA_{-2}$					Instrumented: NPL_{-1} Instruments: $RWA_{-1}\ \Delta non-oil\ GDP_{-1}\ NPL_{-2}\ RWA_{-2}$				

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Model 3 and Model 4- Bank Level (Financial Ratio)

	Model 3					*Model 4*				
Variables	*OLS NPL*	*2SLS NPL*	*FE NPL*	*GMM-DF NPL*	*GMM-SYS NPL*	*OLS NPL*	*2SLS NPL*	*FE NPL*	*GMM-DF NPL*	*GMM-SYS NPL*
NPL_{-1}	0.913***	0.945***	0.473***	0.454***	0.907***	0.934***	0.949***	0.508***	0.420**	0.917***
	(0.038)	(0.0517)	(0.122)	(0.171)	(0.059)	(0.028)	(0.056)	(0.13)	(0.199)	(0.052)
RWA_{-1}	0.0167**	0.0174**	0.028***	0.0590**	0.079***	0.0190**	0.0196**	0.034***	0.0647*	0.076***
	(0.008)	(0.009)	(0.007)	(0.0282)	(0.023)	(0.0084)	(0.009)	(0.008)	(0.034)	(0.022)
ROE_{-1}	-0.019***	-0.019***	-0.021***	-0.018***	-0.017***					
	(0.0011)	(0.001)	(0.0012)	(0.0011)	(0.001)					
ΔGDP_{-1}	-0.072***	-0.0562**	-0.161***	-0.153**	-0.0424	-0.082***	-0.0694**	-0.160***	-0.157**	-0.0521
	(0.0246)	(0.0277)	(0.0486)	(0.067)	(0.038)	(0.024)	(0.0273)	(0.049)	(0.066)	(0.036)
NIM_{-1}						-0.161**	-0.235**	-0.193	-1.145***	-0.329**
						(0.0791)	(0.0947)	(0.262)	(0.343)	(0.144)
Constant	0.242	0.0615	1.867**		-4.555**	0.342	0.543	1.709		-3.431*
	(0.693)	(0.789)	(0.778)		(1.955)	(0.721)	(0.884)	(1.345)		(1.75)
Observations	283	232	283	232	283	283	232	283	232	283
R-squared	0.847	0.830	0.462			0.825	0.806	0.346		
Number of banks			51	50	51			51	50	51
No. of instruments				32	42				32	43
Hansen test p-value				0.30	0.50				0.31	0.56
A-B AR(1) test p-value				0.02	0.10				0.00	0.08
A-B AR(2) test p-value				0.31	0.19				0.14	0.16
IV-2SLS	Instrumented: NPL_{-1} Instruments: $RWA_{-1}\ ROE_{-1}\ \Delta GDP_{-1}\ NPL_{-2}\ RWA_{-2}$					Instrumented: NPL_{-1} Instruments: $RWA_{-1}\ NIM_{-1}\ \Delta GDP_{-1}\ NPL_{-2}\ RWA_{-2}$				

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

With regard to the link between bank performance and NPL, the findings through banks efficiency scores as modelled by Model 5 and Model 6 based on DEA and SFA are presented in Table 5; as can be seen AR(1) and AR(2) results guarantee the consistency of estimators, while the Hansen test also asserts the validity of the utilised instrumental variables. The not-lagged coefficient of efficiency is negatively related with *NPLs* and statistically significant in all of the estimated models, with the exception of the GMM-DF estimate, suggesting that a decline in a bank's efficiency contributes to an increase of around 10% in NPL. This finding evidences for 'bad management' hypothesis in the GCC's commercial banks, which could reflect the management quality; this result in turn corresponds with the panel data findings in the earlier section. This adverse impact could point to the 'bad luck' hypothesis in the sense of external factors relating to macroeconomic variables affecting the GCC's bank performance[8]. The one year lagged coefficient of efficiency is, however, linked to NPL with positive sign, which should be considered as an indication of the 'skimping' hypothesis, signifying to bank policy in reducing credit administration expenses to increase the level of efficiency. The results do, however, indicate that a failure to monitor debtors in the previous year led to an increase in NPL. In addition, Model 6 is conducted to ensure the validity and direction of efficiency scores that were obtained via the DEA approach and utilised in Model 5. As can be seen in table 5, the coefficients of the SFA efficiency scores are not significant and slightly higher than the DEA coefficients; however, they are in the same directions.

[8] In 2006 the stock market of Gulf countries dropped; they then recovered from 22% to 60% in 2007. As a result of the financial global crisis in 2008, the market declined by 29% to 73%. Furthermore, in 2008 the central banks pressed liquidity to the financial system directly through long-term government deposits and indirectly through repos (*see*: Khamis *et al.*, 2010: 10-29).

Table 5: NPL and Bank Efficiency (DEA and SFA) – Model 5 and Model 6

	Model 5					*Model 6*				
Variables	*OLS NPL*	*2SLS NPL*	*FE NPL*	*GMM-DF NPL*	*GMM-SYS NPL*	*OLS NPL*	*2SLS NPL*	*FE NPL*	*GMM-DF NPL*	*GMM-SYS NPL*
NPL_{-1}	0.923***	0.944***	0.503***	0.409**	0.908***	0.929***	0.949***	0.517***	0.387*	0.909***
	(0.0237)	(0.0554)	(0.113)	(0.195)	(0.0391)	(0.0258)	(0.0597)	(0.120)	(0.198)	(0.0387)
RWA_{-1}	0.0156*	0.0140	0.032***	0.0362	0.075***	0.0171**	0.0151*	0.030***	0.0343	0.081***
	(0.0088)	(0.0086)	(0.0084)	(0.0321)	(0.0236)	(0.0082)	(0.0084)	(0.0074)	(0.0345)	(0.0254)
EFF^{DEA}	-0.100**	-0.102*	-0.098*	-0.0629	-0.089**					
	(0.0407)	(0.0515)	(0.0512)	(0.0534)	(0.0450)					
EFF_{-1}^{DEA}	0.0908**	0.0930*	0.0738*	0.107**	0.0657					
	(0.0366)	(0.0508)	(0.0399)	(0.0455)	(0.0406)					
EFF^{SFA}						-0.198*	-0.192	-0.172	-0.164	-0.219
						(0.114)	(0.167)	(0.132)	(0.139)	(0.138)
EFF_{-1}^{SFA}						0.185*	0.183	0.222*	0.284*	0.136
						(0.106)	(0.168)	(0.132)	(0.168)	(0.108)
ΔGDP_{-1}	-0.078***	-0.0597**	-0.164***	-0.159**	-0.0539	-0.085***	-0.0687**	-0.155***	-0.173**	-0.0629*
	(0.0268)	(0.0291)	(0.0497)	(0.0693)	(0.0376)	(0.0247)	(0.0268)	(0.0492)	(0.0682)	(0.0372)
Constant	0.785	0.862	2.898		-2.743*	1.071	0.854	-2.857		1.999
	(0.940)	(1.302)	(3.305)		(1.552)	(2.274)	(2.951)	(5.453)		(3.009)
Observations	283	232	283	232	283	283	232	283	232	283
R-squared	0.834	0.814	0.379			0.832	0.811	0.382		
Number of banks			51	50	51			51	50	51
No. of instruments				33	44				33	44
Hansen test p-value				0.30	0.23				0.38	0.26
A-B AR(1) test p-value				0.00	0.06				0.00	0.05
A-B AR(2) test p-value				0.25	0.19				0.22	0.13
IV-2SLS	Instrumented: NPL_{-1} Instruments: RWA_{-1} EFF^{DEA} EFF_{-1}^{DEA} ΔGDP_{-1} NPL_{-2} RWA_{-2}					Instrumented: NPL_{-1} Instruments: RWA_{-1} EFF^{SFA} EFF_{-1}^{SFA} ΔGDP_{-1} NPL_{-2} RWA_{-2}				

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

With regard to the macro-level sectorial financing variables, tables 6 and 7 present the estimated coefficients for growth rates of MI and the growth rates of REC and the REC of IB. Table 6 presents the results for macro level for Model 7, which includes manufacturing and industry financing variables, while Table 7 depicts the results for macro level Model 8 and Model 9 including the real estate and construction financing variables of CB and IB. In these models, these stated variables are utilised without lag, whereas Table 8 shows the estimation for a model with one-year lag variables. For GMM estimate models, the *p*-value of AR(1) is significant, indicating that there is no serial correlation in AR(2), except the GMM-difference estimated in Model 8. This lack of correlation demonstrates the consistency of the estimators, as given by the result of the Hansen test, which shows that the instrument variables are valid. It should be noted that the sign of all of the sectorial financing variables meets the expectations of the study, excluding the REC variable with one year lag in Model 11 in which coefficient direction varies over the five estimations. Thus, such a result could not be relied on. When comparing the coefficients of MI and REC in models 7 and 8, the results show that they are relatively similar, implying that increasing the MI and REC financing growth in the GCC commercial banks by 1% leads to a decrease of the NPL by about 2%. Similarly, in the GMM-DF estimate the coefficient of RECIB is statistically significant and has a negative impact on NPL.

These findings demonstrate that in the GCC countries there is a substantial interaction between the real GDP growth and business cycle in the economy in relation to the real estate and construction sectors. For instance, in 2008 the financing share of these sectors to total financing in the whole commercial banks and in IB was as follows: 7.3% and 5.6% in Saudi Arabia; 12.9% and 25.7% in the UAE; 26.2% and 11.3% in Bahrain; 18.4% and 38.3% in Qatar; and 31.4% and 22.1% in Kuwait. Noticeably, the risk exposure level of REC in IB is higher in the UAE and Qatar than the other sampled countries (Khamis et al., 2010: 69)[9].

With regard to the RECIB variable with one-year lag in Model 10, the coefficient of RECIB has remained negative and significant in the GMM-DF estimate with approximately a 10% level of significance. The results of this variable, without lag

[9] Large banks in most of the GCC countries are more exposed to real estate and construction financing; further, there is a large concentration of real estate projects by investment funds (*see*: Khamis *et al.*, 2010: 10 and 57).

and with one year lag, is in line with the earlier panel data findings, supporting the fact that the financing for IB is more related to *REC* sector, which increases the risk-exposure level. Furthermore, Khamis et al. (2010) and El Alaoui et al. (2015) study state that in 2009, the performance of IB was affected by the crisis in the real economy in relation to the real estate market; deterioration in this market thus increases NPL. It is therefore suggested that diversification is a crucial step for IB by focusing more on increasing the financing to other sectors that are more engaged with the real economy due to the objective of reducing their risk exposure, such as manufacturing and industry sectors, which relate to the real economy by creating value added through jobs and wealth. Hence, value-added-oriented sectors, including manufacturing industries, should remain an important financing area for IB as expected by the aspirational view put forward by the Islamic moral economy (Asutay, 2012). Given that such sectors relate to generating wealth via the embedding of financing in the real economy, it is believed that the propensity of failure is less than that of the real estate sector[10].

Table 6: Macro-Level Model 7 (including Manufacturing and Industry Financing Variable of GCC Commercial Banks)

			Model 7		
	OLS	*2SLS*	*FE*	*GMM-DF*	*GMM-SYS*
Variables	*NPL*	*NPL*	*NPL*	*NPL*	*NPL*
NPL_{-1}	0.929***	0.945***	0.501***	0.369*	0.920***
	(0.0262)	(0.0538)	(0.127)	(0.189)	(0.0503)
RWA_{-1}	0.0153*	0.0119	0.030***	0.051	0.078***
	(0.0082)	(0.0085)	(0.0083)	(0.0336)	(0.0236)
ΔGDP_{-1}	-0.059**	-0.0327	-0.096**	-0.0999*	-0.0390
	(0.0232)	(0.0267)	(0.0444)	(0.0534)	(0.0378)
ΔMI	-0.0176*	-0.026***	-0.022***	-0.026***	-0.0121
	(0.0089)	(0.0095)	(0.0076)	(0.0080)	(0.0081)
Constant	0.318	0.713	1.392		-4.553**
	(0.677)	(0.786)	(0.874)		(1.930)
Observations	283	232	283	232	283
R-squared	0.827	0.810	0.360		
Number of banks			51	50	51
No. of instruments				32	43
Hansen test p-value				0.26	0.32
A-B AR(1) test p-value				0.01	0.08
A-B AR(2) test p-value				0.24	0.23
IV-2SLS	Instrumented: NPL_{-1} Instruments: $RWA_{-1}\ \Delta MI\ \Delta GDP_{-1}\ NPL_{-2}\ RWA_{-2}$				

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

[10] Indeed, over the current study period the financing average to total financing of the manufacturing sector has presented the lower level among other financing sectors, barely reaching 12% in 2008 (*see*: Figure 4 in the appendix).

Table 7: Macro-Level Model 8 and Model 9
(Including the Real Estate and Construction Financing Variable of CB and IB)

	Model 8					*Model 9*				
	OLS	*2SLS*	*FE*	*GMM-DF*	*GMM-SYS*	*OLS*	*2SLS*	*FE*	*GMM-DF*	*GMM-SYS*
Variables	*NPL*	*NPL*	*NPL*	*NPL*	*NPL*	*NPL*	*NPL*	*NPL*	*NPL*	*NPL*
NPL_{-1}	0.930***	0.948***	0.452***	0.105	0.921***	0.928***	0.942***	0.478***	0.290	0.922***
	(0.0294)	(0.0575)	(0.116)	(0.240)	(0.0512)	(0.0273)	(0.0567)	(0.118)	(0.234)	(0.0492)
RWA_{-1}	0.0140*	0.0137	0.024***	-0.016	0.074***	0.014*	0.014	0.026***	0.029	0.078***
	(0.0082)	(0.0091)	(0.008)	(0.054)	(0.022)	(0.0075)	(0.0085)	(0.0085)	(0.0518)	(0.0232)
ΔGDP_{-1}	-0.0366	-0.0284	-0.105**	-0.156***	-0.0164	-0.0625**	-0.0453	-0.119***	-0.156***	-0.0428
	(0.0304)	(0.0367)	(0.0426)	(0.0529)	(0.0409)	(0.0243)	(0.0298)	(0.0411)	(0.0582)	(0.0368)
ΔREC	-0.021***	-0.017**	-0.035***	-0.048***	-0.016**					
	(0.0067)	(0.0068)	(0.0096)	(0.0181)	(0.0068)					
$\Delta RECIB$						-0.0089**	-0.009*	-0.013**	-0.0153*	-0.0042
						(0.0044)	(0.0047)	(0.0059)	(0.0092)	(0.0039)
Constant	0.515	0.453	2.670***		-4.177**	0.422	0.426	2.053**		-4.638**
	(0.671)	(0.818)	(0.967)		(1.826)	(0.645)	(0.812)	(0.961)		(1.933)
Observations	283	232	283	232	283	283	232	283	232	283
R-squared	0.830	0.809	0.411			0.827	0.807	0.369		
Number of banks			51	50	51			51	50	51
No. of instruments				32	43				32	43
Hansen test p-value				0.09	0.22				0.19	0.41
A-B AR(1) test p-value				0.11	0.08				0.00	0.07
A-B AR(2) test p-value				0.17	0.20				0.17	0.16
IV-2SLS	Instrumented: NPL_{-1} Instruments: $RWA_{-1}\ \Delta REC\ \Delta GDP_{-1}\ NPL_{-2}\ RWA_{-2}$					Instrumented: NPL_{-1} Instruments: $RWA_{-1}\ \Delta RECIB\ \ \Delta GDP_{-1}\ NPL_{-2}\ RWA_{-2}$				

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Macro-Level Model 10 and Model 11
(Including the Real Estate and Construction Financing Variable of *CB* and *IB* with Lagged Variables)

	Model 10					*Model 11*				
	OLS	*2SLS*	*FE*	*GMM-DF*	*GMM-SYS*	*OLS*	*2SLS*	*FE*	*GMM-DF*	*GMM-SYS*
Variables	*NPL*	*NPL*	*NPL*	*NPL*	*NPL*	*NPL*	*NPL*	*NPL*	*NPL*	*NPL*
NPL_{-1}	0.932***	0.948***	0.496***	0.382*	0.925***	0.935***	0.948***	0.508***	0.386**	0.924***
	(0.0288)	(0.0561)	(0.122)	(0.203)	(0.0520)	(0.0248)	(0.0488)	(0.124)	(0.195)	(0.0476)
RWA_{-1}	0.0175**	0.0170*	0.032***	0.0604*	0.084***	0.0165**	0.0131*	0.034***	0.0594*	0.077***
	(0.0086)	(0.0091)	(0.0083)	(0.0332)	(0.0249)	(0.0082)	(0.0076)	(0.0082)	(0.0309)	(0.0241)
$\Delta RECIB_{-1}$	-0.00310	-0.00141	-0.0065*	-0.0077*	-0.00071					
	(0.0044)	(0.005)	(0.0034)	(0.0043)	(0.0046)					
ΔGDP_{-1}	-0.075***	-0.063**	-0.14***	-0.147**	-0.0489	-0.12***	-0.12***	-0.15***	-0.15**	-0.083**
	(0.0252)	(0.0289)	(0.0474)	(0.0623)	(0.0382)	(0.0251)	(0.0271)	(0.0500)	(0.0630)	(0.0323)
ΔREC_{-1}						0.016***	0.024***	-0.000664	-0.0054	0.0107
						(0.00598)	(0.00684)	(0.00721)	(0.00602)	(0.00679)
Constant	0.0293	-0.0101	1.435*		-5.120**	-0.388	-0.244	1.063		-4.822**
	(0.811)	(0.985)	(0.785)		(2.171)	(0.708)	(0.758)	(0.822)		(1.985)
Observations	283	232	283	232	283	283	232	283	232	283
R-squared	0.825	0.805	0.351			0.828	0.812	0.346		
Number of Bank			51	50	51			51	50	51
No. of instruments				32	43				32	43
Hansen test p-value				0.19	0.50				0.29	0.24
A-B AR(1) test p-value				0.01	0.08				0.00	0.07
A-B AR(2) test p-value				0.19	0.18				0.18	0.18
IV-2SLS	Instrumented: NPL_{-1} Instruments: $RWA_{-1}\ \Delta RECIB_{-1}\ \Delta GDP_{-1}\ NPL_{-2}\ RWA_{-2}$					Instrumented: NPL_{-1} Instruments: $RWA_{-1}\ \Delta REC_{-1}\ \ \Delta GDP_{-1}\ NPL_{-2}\ RWA_{-2}$				

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Turning to the macro-level factors of a bank's structural and organisational-development, tables 9 and 10 represent the estimated results for the assets growth according to bank types as seen in models 12, 13, 14, and 15. As the results show, the *p*-values of first-order and second-order autocorrelations prove the consistency of these estimators. In addition, the Hansen test values illustrate the validity of instrumental variables. Starting with the asset growth of IB, the coefficient shows a positive and significant relationship between IBA and NPL, demonstrating that an increase in IBA produces a rise in NPL by about 3%. This implies that the *IBs* may have less ability to diversify in financing portfolios, which results in an increased vulnerability for risk. The coefficient of the IWA (asset growth of *CBs* with *IW*) is also positive but with a small coefficient and not a statistically significant result. With regard to IBIWA variable (*Shari'ah*-compliant assets growth), this again shows a positive link with NPL; nonetheless, it is not significant in all of the estimators. In contrast to the adverse impacts, the relationship between *CBA* growth and *NPLs* is negative and significant in terms of all of the estimators, which specifies that an increase in the growth of *Shari'ah*-compliant finance leads to a decline in *NPLs* by around 30%. This result then implies that these *CB* have more capacity when it comes to diversification in financing projects, which in turn decreases the level of risk-taking.

Table 9: Model 12 and Model 13
Assets Growth for *IBs* and *IWs*

	Model 12					*Model 13*				
Variables	*OLS NPL*	*2SLS NPL*	*FE NPL*	*GMM-DF NPL*	*GMM-SYS NPL*	*OLS NPL*	*2SLS NPL*	*FE NPL*	*GMM-DF NPL*	*GMM-SYS NPL*
NPL_{-1}	0.943***	0.935***	0.451***	0.323*	0.918***	0.947***	0.937***	0.492***	0.341*	0.920***
	(0.0351)	(0.0528)	(0.147)	(0.195)	(0.0500)	(0.0278)	(0.0446)	(0.131)	(0.187)	(0.0381)
RWA_{-1}	0.0219**	0.0205**	0.0390**	0.0872**	0.095***	0.0202**	0.0192**	0.039***	0.0782**	0.0812**
	(0.0095)	(0.0095)	(0.0158)	(0.0429)	(0.0358)	(0.0086)	(0.0093)	(0.0145)	(0.0367)	(0.0320)
ΔGDP_{-1}	-0.08***	-0.08***	-0.22***	-0.24***	-0.085**	-0.07***	-0.067**	-0.18***	-0.18***	-0.0653*
	(0.0257)	(0.0258)	(0.0744)	(0.0777)	(0.0399)	(0.024)	(0.0260)	(0.0513)	(0.0633)	(0.0361)
ΔIBA_{-1}	0.0252**	0.0289**	0.0171	0.0208	0.0346**					
	(0.0117)	(0.0122)	(0.0196)	(0.0150)	(0.0147)					
ΔIWA_{-1}						0.00274	0.00328	0.00217	0.00236	0.00298
						(0.003)	(0.0032)	(0.0039)	(0.0039)	(0.0034)
Constant	-0.441	-0.325	1.241		-6.025**	-0.458	-0.395	0.816		-5.07*
	(0.812)	(0.882)	(1.208)		(2.929)	(0.802)	(0.945)	(1.103)		(2.735)
Observations	239	232	239	188	239	246	232	246	195	246
R-squared	0.806	0.808	0.308			0.808	0.809	0.336		
Number of banks			51	50	51			51	50	51
No. of instruments				30	41				32	43
Hansen test p-value				0.19	0.27				0.33	0.49
A-B AR(1) test p-value				0.00	0.06				0.00	0.05
A-B AR(2) test p-value				0.84	0.90				0.82	0.49
IV-2SLS	Instrumented: NPL_{-1} Instruments: RWA_{-1} ΔIBA_{-1} ΔGDP_{-1} NPL_{-2} RWA_{-2}					Instrumented: NPL_{-1} Instruments: RWA_{-1} ΔIWA_{-1} ΔGDP_{-1} NPL_{-2} RWA_{-2}				

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 10: Model 14 and Model 15
***Shari'ah*-Compliant Assets to Total Assets Growth and Assets of CB to Total Assets Growth Models**

	Model 14					*Model 15*				
Variables	*OLS NPL*	*2SLS NPL*	*FE NPL*	*GMM-DF NPL*	*GMM-SYS NPL*	*OLS NPL*	*2SLS NPL*	*FE NPL*	*GMM-DF NPL*	*GMM-SYS NPL*
NPL_{-1}	0.935***	0.927***	0.421***	0.271	0.905***	0.943***	0.940***	0.399**	0.151	0.915***
	(0.0294)	(0.0423)	(0.134)	(0.196)	(0.0365)	(0.0424)	(0.0608)	(0.160)	(0.192)	(0.0594)
RWA_{-1}	0.0223**	0.0208*	0.0384**	0.0796*	0.0951**	0.0223**	0.0207**	0.036***	0.0413	0.096***
	(0.0107)	(0.0108)	(0.0158)	(0.0413)	(0.0389)	(0.0095)	(0.0095)	(0.0135)	(0.0430)	(0.0341)
GDP_{-1}	-0.09***	-0.09***	-0.23***	-0.29**	-0.093**	-0.07***	-0.07***	-0.27***	-0.36***	-0.077*
	(0.0314)	(0.0293)	(0.0887)	(0.116)	(0.0450)	(0.0259)	(0.0272)	(0.0774)	(0.102)	(0.0407)
$\Delta IBIWA_{-1}$	0.0185	0.0199	0.0351	0.0358	0.0246					
	(0.0198)	(0.0199)	(0.026)	(0.0268)	(0.0237)					
ΔCBA_{-1}						-0.195*	-0.199*	-0.38***	-0.49***	-0.279**
						(0.106)	(0.116)	(0.139)	(0.160)	(0.126)
Constant	-0.511	-0.39	1.24		-6.09*	-0.504	-0.395	1.784		-6.147**
	(0.93)	(1.01)	(1.191)		(3.242)	(0.831)	(0.896)	(1.120)		(2.823)
Observations	239	232	239	188	239	239	232	239	188	239
R-squared	0.807	0.809	0.337			0.807	0.807	0.349		
Number of banks			51	50	51			51	50	51
No. of instruments				30	41				30	41
Hansen test p-value				0.15	0.30				0.19	0.27
A-B AR(1) test p-value				0.00	0.04				0.05	0.08
A-B AR(2) test p-value				0.82	0.62				0.79	0.91
IV-2SLS	Instrumented: NPL_{-1} Instruments: RWA_{-1} $\Delta IBIWA_{-1}$ ΔGDP_{-1} NPL_{-2} RWA_{-2}					Instrumented: NPL_{-1} Instruments: RWA_{-1} ΔCBA_{-1} ΔGDP_{-1} NPL_{-2} RWA_{-2}				

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

The product-development factor findings are presented as formulated in models 16 and 17, which can be seen in Table 11. In both models, the *p*-value of AR(1) is significant and there is no serial correlation in AR(2), which shows the consistency of the estimated models. In addition, the instrumental variables are found to be valid through Hansen test.

By looking at Model 16, the PLS variables with one and two lag have a negative impact on NPL; the coefficient of PLS with two lag is significant in all of the estimators, but there is minor influence for both lagged variables (at about 0.02%), which is attributed to the very low level of financing with PLS contracts. These findings indicate that with two years lagged variables and despite high risk-level involved with PLS instruments, increasing the PLS financing seems to decrease NPL. The other variable related to product-development is FID; the two coefficients, with one and two lags, are positively associated with NPL and they are significant in the GMM-difference model, which is in line with the expectations of this study. Consequently, it can be suggested that in the long term, increasing FID financing increases NPL by around 10%. This result thus indicates that although FID contracts are favourable and heavily utilised by GCC IB due to their low risk-level, the growth influence of FID contracts leads to more NPL than PLS instruments. In other words, it can be concluded that the propensity of credit risk or of generating NPL is higher in FID financing than it is for PLS financing.

Table 11: Macro-Level Model 16 and Model 17
(Including Product-Development Variables)

	Model 16					*Model 17*				
Variables	*OLS NPL*	*2SLS NPL*	*FE NPL*	*GMM-DF NPL*	*GMM-SYS NPL*	*OLS NPL*	*2SLS NPL*	*FE NPL*	*GMM-DF NPL*	*GMM-SYS NPL*
NPL_{-1}	0.945***	0.942***	0.437***	0.339*	0.910***	0.950***	0.946***	0.433***	0.375*	0.912***
	(0.0387)	(0.0583)	(0.150)	(0.198)	(0.0694)	(0.0372)	(0.0562)	(0.148)	(0.200)	(0.0657)
RWA_{-1}	0.0176**	0.0158*	0.0358**	0.136**	0.132**	0.0203**	0.0185**	0.0438**	0.184**	0.132***
	(0.00858)	(0.00869)	(0.0160)	(0.0680)	(0.0537)	(0.00866)	(0.0086)	(0.0173)	(0.0743)	(0.0504)
GDP_{-1}	-0.079***	-0.0753**	-0.215***	-0.174*	-0.0545	-0.0640**	-0.059**	-0.175**	-0.109	-0.0386
	(0.0272)	(0.0287)	(0.0703)	(0.0951)	(0.0577)	(0.0268)	(0.0280)	(0.0719)	(0.110)	(0.0571)
ΔPLS_{-1}	-0.0002***	-0.00017**	-0.000115	-0.000178	-4.77e-06					
	(5.69e-05)	(6.50e-05)	(8.58e-05)	(0.00018)	(0.0001)					
ΔPLS_{-2}	-0.0002***	-0.0002***	-0.0002***	-0.00038**	-0.0002*					
	(4.89e-05)	(5.78e-05)	(6.96e-05)	(0.00015)	(9.42e-05)					
ΔFID_{-1}						0.0994	0.0922	0.124*	0.195**	0.107
						(0.0729)	(0.0651)	(0.0618)	(0.0893)	(0.0657)
ΔFID_{-2}						0.00572	0.0358	0.108**	0.157*	0.0633
						(0.0372)	(0.0500)	(0.0432)	(0.0822)	(0.0578)
Constant	0.0970	0.226	1.691		-8.799**	-0.310	-0.158	0.880		-8.872**
	(0.769)	(0.871)	(1.270)		(4.439)	(0.740)	(0.823)	(1.295)		(4.100)
Observations	239	232	239	188	239	239	232	239	188	239
R-squared	0.806	0.807	0.309			0.805	0.806	0.314		
Number of banks			51	50	51			51	50	51
No. of instruments				23	32				23	32
Hansen test p-value				0.24	0.22				0.12	0.18
A-B AR(1) test p-value				0.02	0.09				0.00	0.07
A-B AR(1) test p-value				0.98	0.72				0.92	0.80
IV-2SLS	Instrumented: NPL_{-1} Instruments: RWA_{-1} ΔPLS_{-1} ΔPLS_{-2} ΔGDP_{-1} NPL_{-2} RWA_{-2}					Instrumented: NPL_{-1} Instruments: RWA_{-1} ΔD_{-1} ΔD_{-2} ΔGDP_{-1} NPL_{-2} RWA_{-2}				

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; the GMM style model with three lag.

7.2 Robustness Check Using Panel Data Models

To check the validity of IB results we apply panel data, fixed and random effect models, as another approach to examine the IB nexus with NPL. Another aim of this paper is to apply robustness check, for the determinants of NPL for the IB and IW, to consider the link between NPL and bank-level country-level factors, in particular, the variables represent IB sectoral financing and Islamic financing methods. To do so we include only IB and IW only form our data sample.

The passages below present the results that describe the relationship between NPL and explanatory variables in the sampled IB and CB that provide IW in the GCC countries via OLS (with cluster robust), FE models, and RE models[11].

Table 12 shows the results for Model 18, which focuses on the impact of bank level and macroeconomic variables in NPL. As can be seen, the Hausman specification test clearly rejects the null hypothesis for Model 18, implying that the RE estimate significantly differs from the FE estimate. Therefore, the FE specification is preferred, yet in Model 19 the null hypothesis is accepted, meaning that both estimators, FE and RE, are consistent and that systematically there is no difference. Thus, in this case the RE estimator is preferred. Model 19 is, however, conducted to check the robustness of the Model 18 estimation, especially with regard to the direction of the obtained efficiency scores from the DEA and SFA methods. The coefficient of the RWA variable is statistically significant in all panel data estimators and positively related to NPL, which is in line with Berger and DeYoung (1997), which specifies that a rise in RWA, indicating a higher credit risk portfolio, leads to an increase in NPL by around 3%.

With regard to the estimated coefficients of performance and profitability ratios, ROE and NIM, the relationship between ROE and NPL is negative and significant in all of the estimated models. This result indicates that a decrease in ROE leads to an increase in the NPL by about 12%, suggesting that the short-term effect of the managements of IB and IW may be not efficient enough when controlling the credit risk portfolios. This could verify the 'bad management' hypothesis, which is consistent with the study by Louzis et al. (2012). Essentially, the financing portfolios of the GCC banks depend on FID contracts with more

[11] To detect for a multicollinearity problem, Variance Inflation Factor (VIF) is utilised in all of the panel data estimate models; according to this test it is found that in each of the explanatory variables the value of VIF is less than 1.30, which signifies that there is no multicollinearity (Greene, 2007: E5-18). This test is presented in the appendix section.

than 80% of total financing; in the short term the profits could thus increase dramatically due to the heavy reliance on these contracts, which in turn lead to a rise in the ROE.

Table 12: Panel Data Estimate Results for Models 1 and 2 (with Bank-level and Macroeconomic Variables)

	Model 18			*Model 19*		
	OLS robust	*FE*	*RE*	*OLS robust*	*FE*	*RE*
Variables	*NPL*	*NPL*	*NPL*	*NPL*	*NPL*	*NPL*
RWA	0.0165	0.0368***	0.0319**	0.0146	0.0269*	0.0258**
	(0.0151)	(0.0140)	(0.0133)	(0.0145)	(0.0138)	(0.0130)
ROE	-0.114*	-0.145***	-0.123***	-0.128**	-0.146***	-0.131***
	(0.0562)	(0.0251)	(0.0230)	(0.0605)	(0.0254)	(0.0228)
NIM	0.185	0.792***	0.429*	0.199	0.775***	0.423*
	(0.221)	(0.282)	(0.227)	(0.231)	(0.286)	(0.226)
EFF^{DEA}	-4.341	-10.65***	-7.140***			
	(3.092)	(2.557)	(2.150)			
EFF^{SFA}				-10.19**	-18.71***	-14.76***
				(4.686)	(5.118)	(4.498)
ΔGDP	-0.0599*	-0.0213	-0.0541	-0.0473	-0.0387	-0.0550
	(0.0302)	(0.0655)	(0.0558)	(0.0310)	(0.0659)	(0.0557)
Constant	6.605**	7.473***	6.429***	12.04**	16.17***	14.02***
	(2.958)	(2.071)	(1.867)	(4.388)	(4.275)	(3.813)
Observations	198	198	198	198	198	198
R-squared	0.214	0.310		0.216	0.294	
Number of banks		31	31		31	31
Chi2(3)			10.53			6.5
Hausman Prob>chi2			0.06			0.26

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

In the case of the NIM variable, the estimated coefficient shows having a positive impact on NPL, implying that increasing the NIM boosts NPL by about 42%. Thus, the findings provide evidence that the transactions of IB and Islamic financing tend to be risker than other counterparties, specifically when PLS contracts are involved, wherein these transactions could produce a significant profit, but they are riskier than FID and other financial contracts that lead to higher defaulted loans.

As can be seen in Table 12, the efficiency coefficient is significant in all of the panel data estimators and associated negatively with NPL, proving, in the short term, the 'bad management' hypothesis in IB and CB with IW. It should be noted that the observed negative relationship supports the 'bad luck' hypothesis resulting from the stock market downturn in 2006 in most of the GCC countries, in addition to the global financial crisis over the period of 2008 to 2009 (Khamis *et al.*, 2010). All of these external factors might have taken place to

create higher costs in administrating bank solvency and problem loans, which have an adverse effect on efficiency.

The findings of Model 20 are depicted in Table 13, which presents the results for organisational, product-development, and macroeconomic variables. As depicted, the Hausman test results indicate the acceptance of the null hypothesis, thereby illustrating that both estimators are consistent and that the RE estimator is favourable. By looking at the variables related to Islamic financing contracts and despite that the coefficient of PLS growth rate is relatively small, it is statistically significant and it has a negative relationship with NPL. This finding demonstrates that the nature of PLS contracts are risker than other Islamic financing contracts, and increasing transactions with such instruments in the short term may lead to a decline in NPL, given that a higher risk financing portfolio, namely PLS-oriented contracts, could bring higher revenue.

As the results in Table 13 show, the FID variable represents a significant and positive relationship with NPL, which corresponds to the expectations of this study, implying that due to risk-level-related reasons the financing portfolios of most of the IB in the GCC countries concentrate on FID-oriented financing and loans due to the high risk associated with PLS contracts.

In relation to macro-level factors, the results in Table 13 show that the real *GDP* growth coefficient illustrates a negative link with NPL (from 5% to 10%), supporting the 'prosperity' hypothesis and implying that the growth in real macroeconomic terms has a direct but adverse impact on NPL. In addition, the growth rate of RECIB financing has a significant and negative impact on NPL, signifying that an increase in financing such sectors by 1% led to a decline in NPL by about 3%. Such findings suggest the interaction between real GDP and business cycle related to RECIB is high and that the growth of both variables decreases the NPL. This can be explained by the reason that IB in the GCC countries are more exposed to real estate market risk because they heavily directed their financing to this particular sector[12].

[12] *See* Figure 4 in the appendix, which illustrates that the average of financing percentage for each sector to total financing in IB in GCC countries, whereas the proportion of real estate and construction sector has increased gradually since 2005 and has remained in the highest level among other sectors in 2009 and 2010.

Table 13: Panel Data Estimate Results (with Organisational, Product-Development, and Macroeconomic Variables)

	Model 20		
	OLS robust	*FE*	*RE*
Variables	*NPL*	*NPL*	*NPL*
RWA	0.0086	0.0248*	0.0201
	(0.011)	(0.0140)	(0.0131)
Δ*PLS*	-0.00069***	-0.00043**	-0.0005***
	(0.00017)	(0.00018)	(0.00017)
Δ*FID*	0.210***	0.174**	0.187**
	(0.065)	(0.0752)	(0.0737)
Δ*RECIB*	-0.033***	-0.0250***	-0.0272***
	(0.0097)	(0.0054)	(0.0052)
Δ*GDP*	-0.111***	-0.105	-0.108**
	(0.0377)	(0.066)	(0.054)
Constant	5.361***	3.625***	4.112***
	(1.462)	(1.259)	(1.202)
Observations	198	198	198
R-squared	0.240	0.236	
Number of banks		31	31
Chi2(3)		3.12	
Hausman Prob>chi2		0.68	

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

8. Concluding Remarks

In this paper we use GMM models to examine the impact of the sectoral distribution of Islamic financing on NPL in the GCC's banking system, which helps to locate the impact of sectoral Islamic financing and Islamic financing methods on the NPL in the GCC's commercial banking sector. With regard to the results, the real GDP growth supports the 'prosperity' hypothesis and implies that the growth in real macroeconomic terms has a negative impact on NPL.

In terms of bank-specific factors, RWA play a vital role as an early warning indicator for increasing NPL, as it reflects the high-level risk of loans portfolio combination. The association between non-lagged efficiency and NPL supports the 'bad management' hypothesis, this negative relationship could indicate the 'bad luck' case, which may be caused by external factors that create more costs in administrating bank solvency and problem loans, such as the downturn in 2006 and the global financial crisis from 2008 to 2009 [13]. The one-year lag efficiency variable is, however, positively associated with NPL, suggesting the presence of the 'skimping' policy in reducing credit administration expenses. In addition and

[13] Lagoarde-Segot (2015) indicates that consequences of financial crisis in academic research could be a problematic issue, as some studies have argued that the financial crisis was a crisis of values. The debatable point is that 'facts' are measurable factors but 'values' are not, therefore a number of finance studies do not involve the terms of 'values' and 'ethics' in their research.

due to the previous year, there could be a shortage in monitoring borrowers, which increases NPL.

In terms of macro-level sectoral financing, the growth rates of MI and REC present a relatively similar adverse impact on NPL. The RECIB financing shows a negative impact on NPL; these findings suggest that in the GCC countries, there is a substantial interaction between the real GDP growth and the real estate and construction sectors, supporting the notion that the financing of IB is more related to real estate and construction projects, which increases the risk exposure. Hence, it is suggested that diversification is a crucial step required for bank managers and policy makers in the GCC region. Indeed, they need to focus more on increasing the financing to other sectors that are embedded within the real economy such as manufacturing and other productive industries so that the risk of NPL can be reduced as the relative propensity of failure is less in these sectors than in the real estate sector.

The findings related to the banks' structural and organisational development factors show that an increase in the assets growth for IB leads to an increase in NPL, indicating that IB could have less ability to diversify in financing portfolios. This would in turn mean that these banks are more at risk. On the other hand, the relationship between CBA growth and NPL is negative, suggesting that these CB are more capable in diversifying financing projects and hence decreasing risk taking. Overall, Lagoarde-Segot and Lucey (2007) suggest that transparency in economics and financial institutions is a vital to sustain portfolio returns.

The product development of IF factors demonstrates that the PLS growth shows negative impact on NPL, but with minor impact, which is attributed by the very low level of financing with PLS contracts. Such findings suggest that despite the high risk-level in PLS instruments, increasing the PLS financing could lead to a decrease in NPL. The FID variable did, however, present a positive relationship with NPL, indicating that although FID contracts are favoured by IB in the GCC, the growth path of FID financings could harm the loan quality more than PLS instruments.

It should be noted that the causes behind NPL can be attributed to macroeconomic, financial, or institutional factors, and this study, therefore, investigated several economic causations between NPL and some selected macro-level and micro-level factors, which are classified into endogenous and exogenous factors, by utilising the dynamic panel data (GMM) models. Furthermore, in the present Islamic banking literature on the subject of loan quality issues, no

study has yet attempted to examine the impact of Islamic financing and Islamic finance contracts on NPL; this gap, thus, points to the significance of this study and its contributions, which examines the effects on the loan quality of the GCC's commercial banking sector.

Future research could utilise other empirical techniques such as Granger causality in addition to the dynamic panel data models so as to examine the intertemporal relationships. Further, the relationship between Islamic financing, Islamic contracts, and NPL could be equally explored by taking into account the longer time period, to examine longer dynamic effects by increasing the lag numbers, which enables the application of different estimates such as the panel vector autoregressive.

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Appendix

Variance inflation factor (VIF) Multicollinearity test

Model 1			*Model 2*			*Model 3*		
Variables	*VIF*	*1/VIF*	*Variables*	*VIF*	*1/VIF*	*Variables*	*VIF*	*1/VIF*
RWA	*1.04*	*0.9631*	*RWA*	*1.02*	*0.9778*	*RWA*	*1.02*	*0.9813*
ROE	*1.27*	*0.7879*	*ROE*	*1.15*	*0.8717*	*ΔPLS*	*1.08*	*0.9288*
NIM	*1.11*	*0.9045*	*NIM*	*1.09*	*0.9166*	*ΔFID*	*1.05*	*0.9506*
EFF^{DEA}	*1.16*	*0.8608*				*ΔRECIB*	*1.12*	*0.8965*
			EFF^{SFA}	*1.07*	*0.9343*			
ΔGDP	*1.07*	*0.9331*	*ΔGDP*	*1.10*	*0.9125*	*ΔGDP*	*1.03*	*0.9667*
Mean VIF	*1.13*		*Mean VIF*	*1.09*		*Mean VIF*	*1.06*	

Model 4			*Model 5*		
Variables	*VIF*	*1/VIF*	*Variables*	*VIF*	*1/VIF*
NPL_{-1}	*1.03*	*0.9752*	NPL_{-1}	*1.01*	*0.9872*
RWA_{-1}	*1.02*	*0.9804*	RWA_{-1}	*1.01*	*0.9920*
ΔGDP_{-1}	*1.01*	*0.9900*	$\Delta nonoil\ GDP_{-1}$	*1.01*	*0.9929*
Mean VIF	*1.02*		*Mean VIF*	*1.01*	

Model 6			*Model 7*		
Variables	*VIF*	*1/VIF*	*Variables*	*VIF*	*1/VIF*
NPL_{-1}	*1.04*	*0.9587*	NPL_{-1}	*1.03*	*0.9752*
RWA_{-1}	*1.01*	*0.9895*	RWA_{-1}	*1.02*	*0.9763*
ROE_{-1}	*1.02*	*0.9805*	NIM_{-1}	*1.02*	*0.9828*
ΔGDP_{-1}	*1.02*	*0.9794*	ΔGDP_{-1}	*1.02*	*0.9779*
Mean VIF	*1.02*		*Mean VIF*	*1.02*	

Model 8			*Model 9*		
Variables	*VIF*	*1/VIF*	*Variables*	*VIF*	*1/VIF*
NPL_{-1}	*1.17*	*0.8565*	NPL_{-1}	*1.14*	*0.8738*
RWA_{-1}	*1.05*	*0.9541*	RWA_{-1}	*1.08*	*0.9277*
EFF^{DEA}	*4.50*	*0.2222*	EFF^{SFA}	*2.80*	*0.3572*
EFF_{-1}^{DEA}	*4.51*	*0.2217*	EFF_{-1}^{SFA}	*2.79*	*0.3582*
ΔGDP_{-1}	*1.02*	*0.9792*	ΔGDP_{-1}	*1.03*	*0.9707*
Mean VIF	*2.45*		*Mean VIF*	*1.77*	

Model 10			*Model 11*		
Variables	*VIF*	*1/VIF*	*Variables*	*VIF*	*1/VIF*
NPL_{-1}	*1.06*	*0.9453*	NPL_{-1}	*1.04*	*0.9596*
RWA_{-1}	*1.02*	*0.9835*	RWA_{-1}	*1.01*	*0.9946*
ΔIBA_{-1}	*1.08*	*0.9290*	ΔIWA_{-1}	*1.02*	*0.9809*
ΔGDP_{-1}	*1.07*	*0.9366*	ΔGDP_{-1}	*1.03*	*0.9732*
Mean VIF	*1.05*		*Mean VIF*	*1.02*	

Model 12			*Model 13*		
Variables	*VIF*	*1/VIF*	*Variables*	*VIF*	*1/VIF*
NPL_{-1}	*1.10*	*0.9130*	NPL_{-1}	*1.05*	*0.9495*
RWA_{-1}	*1.02*	*0.9850*	RWA_{-1}	*1.02*	*0.9810*
$\Delta IBIWA_{-1}$	*1.13*	*0.8841*	ΔCBA_{-1}	*1.05*	*0.9482*
ΔGDP_{-1}	*1.10*	*0.9116*	ΔGDP_{-1}	*1.04*	*0.9584*
Mean VIF	*1.08*		*Mean VIF*	*1.04*	

Model 14			*Model 15*			*Model 16*		
Variables	*VIF*	*1/VIF*	*Variables*	*VIF*	*1/VIF*	*Variables*	*VIF*	*1/VIF*
NPL_{-1}	*1.04*	*0.9658*	NPL_{-1}	*1.03*	*0.9732*	NPL_{-1}	*1.04*	*0.9614*
RWA_{-1}	*1.03*	*0.9671*	RWA_{-1}	*1.03*	*0.9679*	RWA_{-1}	*1.06*	*0.9450*
ΔMI	*1.13*	*0.8810*	ΔREC	*1.20*	*0.8299*	$\Delta RECIB$	*1.13*	*0.8864*
ΔGDP_{-1}	*1.11*	*0.8994*	ΔGDP_{-1}	*1.19*	*0.8398*	ΔGDP_{-1}	*1.08*	*0.9276*
Mean VIF	*1.08*		*Mean VIF*	*1.11*		*Mean VIF*	*1.08*	

Model 17			*Model 18*		
Variables	*VIF*	*1/VIF*	*Variables*	*VIF*	*1/VIF*
NPL_{-1}	*1.03*	*0.9750*	NPL_{-1}	*1.04*	*0.9624*
RWA_{-1}	*1.02*	*0.9851*	RWA_{-1}	*1.02*	*0.9851*
ΔREC_{-1}	*1.21*	*0.8243*	$\Delta RECIB_{-1}$	*1.05*	*0.9486*
ΔGDP_{-1}	*1.23*	*0.8139*	ΔGDP_{-1}	*1.05*	*0.9519*
Mean VIF	*1.12*		*Mean VIF*	*1.04*	

Model 19			*Model 20*		
Variables	*VIF*	*1/VIF*	*Variables*	*VIF*	*1/VIF*
NPL_{-1}	*1.06*	*0.9460*	NPL_{-1}	*1.04*	*0.9580*
RWA_{-1}	*1.01*	*0.9886*	RWA_{-1}	*1.01*	*0.9904*
ΔPLS_{-1}	*1.03*	*0.9693*	ΔFID_{-1}	*1.05*	*0.9547*
ΔPLS_{-2}	*1.03*	*0.9702*	ΔFID_{-2}	*1.03*	*0.9722*
ΔGDP_{-1}	*1.06*	*0.9466*	ΔGDP_{-1}	*1.05*	*0.9538*
Mean VIF	*1.04*		*Mean VIF*	*1.04*	